The Geology of
Central Utah

A report by

Jonathon Mayhew

Submitted as partial fulfillment of
the requirements for the
Bachelor of Science degree
at the Ohio State University
winter quarter 1983

approved by
George E Moore, Jr.

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ILLUSTRATIONS

ACKNOWLEDGMENTS

Sincere appreciation is extended to Dr. George E. Moore for his clarifying remarks during the writing of this paper.

INTRODUCTION

This report will describe the geology of central Utah, an area that includes the western part of the Wasatch Plateau, the Sanpete Valley, and the eastern part of the Gunnison Plateau. Data was obtained from as far north as Wales and as far south as Richfield. The strata exposed in the area range from Upper Jurrasic to present in age.

The field work for this report was done in a part of the area known as the High Plateaus of Utah, which covers about 2,300 square miles. In this area there are several north-south-trending plateaus that are approximately 10,000 to 11,000 feet above sea level. The Wasatch Plateau is the easternmost of these plateaus. There is some question as to whether the Wasatch Plateau belongs to the Colorado Plateau province or to the Basin and Range province. Gilliland (1951, p. 1) provided good reason for placing this boundary, between the Colorado Plateau province and the Basin and Range province, at about the mid-line of the Wasatch Plateau. Gilliland's decision to include the Wasatch Plateau in the Basin and Range province was based on drainage patterns and structural complexities. The Basin and Range province is generally characterized by internal drainage and local folding and faulting. The eastern portion of the Wasatch Plateau is composed of nearly flat-lying rocks, which is typical of the Colorado Plateau province. The western portion of the Wasatch Plateau is a steep monocline with many steep faults, which is more typical of the Basin and Range province. The Gunnison Plateau, which is west of the Wasatch Plateau, is the result of block faulting. This block faulting is also typical of the Basin and Range province. The uplift that caused the Gunnison Plateau is very recent and is probably still occuring. The Sanpitch River transports some runoff from the area and empties into the Sevier River, which empties into the Sevier Lake. This interior drainage is also typical of the Basin and Range province.

The economy of central Utah is mainly based on agriculture. Parts of the Sanpete Valley and the Sevier Valley, which were covered by sagebrush, have been converted to luxurious grasslands through modern irrigation and farming techniques. These valleys are very dry during the summer months. Richardson (1907, p. 15) reported that the mean annual precipitation at Manti, Utah from 1899 to 1905 was 11.35 inches. When it rains in the summer, most of the water is absorbed before it reaches any stream. Ephemeral streams in the area are characterized by flash floods after storms of short duration. The farmers get water by channeling the meltwaters from the plateaus to their fields. These plateaus locally retain snow throughout the year. Livestock, mainly turkeys, sheep, and cattle, is an important commodity. A small amount of revenue in central Utah comes from the mining of salt, bentonite, stone, gravel, and coal. Some lead, and zinc were mined in the past.

C. E. Dutton (1880) described the geology of this area in his report on the High Plateaus of Utah. Spieker and Reeside later added much detail to the geology of the area (Spieker and Reeside, 1925), as did Spieker (1946). Gilliland (1951) made a detailed report of the geology of the Gunnison Quadrangle.

The formations discussed in this report are shown in table 1.

Table 1

System	Series		Formation
Tertiary	Eocene		Green River Formation
			Colton Formation
	Paleocene		Flagstaff Limestone
Cretaceous	Upper Cretaceous		North Horn Formation
			Price River Formation
		Indianola Group	Sixmile Canyon Formation
			Funk Valley Formation
			Allen Valley Shale
			Sanpete Formation
Jurassic	Upper Jurassic		Morrison (?) Formation
			Twist Gulch Formation
			Arapien Shale

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STRATIGRAPHY

Jurassic System

Three formations exposed in the area belong to the Jurassic System. These are the Arapien Shale, the Twist Gulch Formation, and the Morrison (?) Formation. These formations are all upper Jurassic.

Arapien Shale and Twist Gulch Formation

Definition:

Spieker (1946, p. 123) defined the Arapien Shale as a formation with two members, the lower Twelvemile Canyon member and the upper Twist Gulch member. These members were later upgraded to formation rank (Gilliland, 1951, p. 10). The lower Twelvemile Canyon member is now the Arapien Shale, and the upper Twist Gulch member is now the Twist Gulch Formation. The type locality for Spieker's undifferentiated Arapien Shale is the Arapien Valley, which lies parallel to the base of the Wasatch Plateau about six miles southeast of Gunnison. The type locality of the Twelvemile Canyon member is the valley of Twelvemile Creek, west of Arapien Valley, and that of the Twist Gulch member is on the north side of Salina Canyon in Twist Gulch.

Description of Formation:

The rocks that make up the Arapien Shale and the Twist Gulch Formation are mostly shale. These shales are very suseptible to weathering and erosion. In many places, they form a badlands type of topography with low rugged foothills.

Spieker (1946, p. 124) described five units in the Arapien Shale and Twist Gulch Formation. These are as follows: 1. A basal gray limestone, generally thin-bedded. 2. Light-gray siltstone and shale, very thin-bedded, with occasional thin beds of finely rippled sandstone. 3. Gray shale, argillaceous and gypsiferous, with irregular red blotches, which locally become dominant. 4. Compact red salt-bearing shale. 5. Thin-bedded red siltstone and shale with many thin layers of greenish white siltstone and occasional zones of gray sandstone, some of which is fairly coarse-grained.

The upper unit (no. 5), which lies above the compact red salt-bearing shale, was described by Spieker as the Twist Gulch member. The upper unit is the only one that can be mapped for a considerable distance in any direction.

Gilliland (1951, p. 13) reported finding beds of nearly pure white salt not more than two feet thick, alternating with thick red layers, in the Gunnison Quadrangle. He also reported the presence of at least 200 feet of salt in the Redmond Hills. The Arapien Shale and the Twist Gulch Formations were deposited in a closed-basin marine environment.

Distribution and Thickness:

The Arapien Shale and the Twist Gulch Formation are exposed in a nearly continuous belt along the east side of the Sevier Valley from Gunnison southward to Richfield, locally along the western base of the Gunnison Plateau, in discontinuous outcrops along the east base of the Gunnison Plateau, and at the southern end of the Wasatch Mountains.

The base of the Arapien Shale has not been observed in this area. The top of the Twist Gulch Formation is observable in many localities, but similarities between the lithologies of the Twist Gulch Formation and the overlying formations make it difficult to draw the boundary. Spieker (1946, p. 125) estimated that the combined thickness of the Arapien Shale and the Twist Gulch Formation is more than 10,000 feet. He measured the thickness of the Twist Gulch Formation at about 3,000 feet in Salina Canyon.

Stratigraphic Relations:

Spieker (1946, p. 125) stated that there is intertonguing between the the top of the Twist Gulch Formation and the overlying Morrison (?) Formation in Salina Canyon. The contact between the Arapien Shale and the Twist Gulch Formation is gradational at all localities in central Utah where it has been observed. The base of the Arapien Shale has not been observed.

Age and Correlation:

Spieker (1949, p. 125) reported finding fossils only in a gray unit of the Arapien shale. He found *Pentacrinus astericus* Meek and Hayden, *Ostea strigilecula* White, *Trigonia aff. T. quadrangularis* Hall and Whitfield, *Camptonectes cf. C. extenuatus* Meek and Hayden, *Camptonectes cf. C. stygius* White, *Volsella subimbricata* Meek, and *Lysoma sp.* These have been assigned to the upper Jurassic by J. B. Reeside, Jr.

Spieker (1946, p. 123) correlated the Arapien Shale and the Twist Gulch Formation with the San Raphael Group of southeastern Utah, and the Twin Creek Limestone of north-central Utah.

Morrison (?) Formation

Definition:

Spieker (1946, p. 126) described the Morrison (?) Formation as the variegated beds that lie above the Jurassic shales in central Utah. The Morrison (?) Formation is tentatively correlated with the Morrison Formation, however, some special problems, which are discussed below, make this correlation uncertain.

Description of Formation:

The Morrison (?) Formation consists of variegated shale, sandstone, and conglomerate. The shale is red, pink, and yellow, and is commonly interbedded with pale-colored shale, and sandstone. The conglomerate contains clasts of limestone and chert 2 to 4 inches in diameter; the chert clasts are black, brown, and green, which is important in its determination as Morrison.

Distribution and Thickness:

Spieker (1946, p. 125) stated that the Morrison (?) Formation occurs in the Salina district, and in the Thistle district. He said that no strata have ever been assigned to the Morrison(?) Formation in other parts of the western Wasatch Plateau or the adjacent valleys, but it is possible that some of the conglomerates and red beds included in the Indianola Group (undifferentiated) are the same as those designated as Morrison (?).

Spieker (1946, p. 125) measured the Morrison (?) Formation at 1,300 feet thick in the Salina district, and at 1,800 feet thick in the Thistle district.

Stratigraphic Relations:

The Morrison (?) Formation lies above the Twist Gulch Formation, and below the Indianola Formation. The contact between the Morrison (?) Formation and the Twist Gulch Formation is a gradational one.

Age and Correlation:

The Morrison (?) Formation has been assigned to the upper Jurassic. The lack of fossils and the similarity between Morrison (?) and Indianola lithologies has made the correlation as Morrison uncertain. Spieker (1946, p. 125) listed three reasons for correlating the Morrison (?) Formation with the true Morrison. 1. The Morrison (?) conglomerate contains black, brown, and green chert clasts, which is distinctive of Morrison conglomerates of the northern San Raphael Swell. The Indianola conglomerate contains little or no chert. 2. The gradational contact between the Twist Gulch Formation and the Morrison (?) Formation suggests a Jurassic age. 3. The Morrison (?) beds in Salina Canyon are not exactly like the Indianola beds. The Morrison (?) Formation, exposed at Salina Canyon, contains no fresh-water limestones, and the variegated beds are paler and more delicate in tint than the Indianola.

Cretaceous System

The Indianola Group is the oldest representative of the Cretaceous System in central Utah. The Price River Formation lies above the Indianola Group, and the lower part of the North Horn Formation was deposited during upper Cretaceous time.

Indianola Group

The Indianola Group is the sandstone, shale, and conglomerate that lies above the Morrison (?) Formation and below the Price River Formation. Four formations have been defined in the Indianola Group. These formations can not be differentiated at some localities, and are considered to be one formation where undifferentiable. The type locality of the Indianola is in the vicinity of Indianola, Utah. The group, where it can be diveded contains the Sanpete Formation, at the base, followed by the Allen Valley Shale, the Funk Valley Formation, and the Sixmile Canyon Formation.

Sanpete Formation

Definition:

Spieker (1946, p. 127) gave the name Sanpete Formation to the series of sandstone, conglomerate, and shale that makes up the lowest formation of the Indianola Group. The name comes from Sanpete Valley, where the formation is exposed south of Manti, Utah.

Description of Formation:

The Sanpete Formation consists of Brown, buff, and gray sandstone, gray conglomerate, and some gray to ochre shale.

Distribution and Thickness:

In addition to the exposure in Sanpete Valley, the Sanpete Formation is exposed in Salina Canyon Canyon, and in the canyon of Lake Fork.

Spieker (1946, p. 127) reported a thickness 1,350 feet feet of Sanpete strata at Salina Canyon. This is the only locality where the entire formation is exposed.

Stratigraphic Relations:

The Sanpete Formation lies conformably above the Morrison (?) Formation and below the Allen Valley Shale in Salina Canyon.

Age and Correlation:

Spieker (1946, p. 127) stated that the Sanpete Formation contains fossils of lower Colorado age, and he correlated the formation with the basal unit of the Mancos Shale to the east. Spieker suggested a near-shore zone of deposition, intermediate between open sea to the east and mountain front to the west.

Allen Valley Shale

Definition:

Spieker (1946, p. 127) defined the Allen Valley Shale as the beds of mostly shale, which lie between the sandstone of the Sanpete and Funk Valley formations. The Type locality is at Allen Valley, at the base of the Wasatch Plateau, about three miles southwest of Manti.

Description of Formation:

The Allen Valley Shale is composed of even-bedded gray marine shale, interbedded with thin layers of yellowish bentonite, siltstone, very fine-grained sandstone, and gray limestone.

Distribution and Thickness:

In addition to the exposure at the type locality, the Allen Valley Shale is also exposed at Sixmile Canyon and Salina Canyon.

Spieker (1946, p. 127) reported a thickness of 620 feet at the type locality, and 850 feet in Salina Canyon.

Stratigraphic Relations:

The Allen Valley Shale lies conformably above the Sanpete Formation, and conformably below the Funk Valley Formation.

Age and Correlation:

J. B. Resside, Jr. identifeid Allen Valley fossils to be of middle Colorado age. This age correlates the Allen Valley Shale with the Ferron sandstone member of the Mancos Shale in Castle Valley. The age correlation indicates an embayment of the Mancos sea.

Funk Valley Formation

Definition:

The Funk Valley Formation is the name that Spieker (1946, p. 128) gave to the assemblage of marine sandstone and shale that lies above the Allen Valley Shale. The type locality is in the ridges bordering Funk Valley, 3 to 4 miles southwest of Manti.

Description of Formation:

Spieker (1946, p. 128) recognized three units in the Funk Valley Formation: 1. The basal sandstone unit, which is interbedded with shale and is about 900 feet thick. 2. A middle gray marine shale unit that is about 650 feet thick. 3. An upper sandstone member that is about 700 feet thick. The sandstones are white to cream, and buff to brown.

Distribution and Thickness:

In addition to the exposure at the type locality, the formation is also exposed in Salina Canyon, in Cedar Hills, and it forms the marginal foothills of the Wasatch Plateau for more than four miles south of Crystal Springs on the western margin of the Wasatch Plateau.

Age and Correlation:

The sandstone units contain fossils of Colorado age, which lead to a correlation with that part of the Mancos Shale immediately above the Ferron Sandstone member.

Sixmile Canyon Formation

Definition:

Spieker (1946, p. 128) defined the Sixmile Canyon Foration as the coarse-grained gray sandstone and conglomerate, containing a coal-bearing member of finer grain, which lies above the Funk Valley Formation. The type locality is in Sixmile Canyon.

Description of Formation:

Spieker (1946, p. 128) recognized three units in the Sixmile Canyon Formation. 1. The basal unit of gray conglomerate, which is about 2,000 feet thick. 2. A coal-bearing member, with gray to cream and white fine-grained sandstone, gray to white shale, and coal, which is about 300 feet thick. 3. The upper member of conglomerate and conglomeratic sandstone, which is about 425 feet thick.

Distribution and Thickness:

The Sixmile Canyon Formation is exposed only at the type locality. The top of the formation is not exposed in the area, so the total thickness of the formation is unkown.

Age and Correlation:

Fossil plants and molluscs from the coal bearing member were determined by R. W. Brown and J. B. Reeside, Jr. to be of lower Colorado age. The upper member contains no fossils, the age has not been proved. Spieker included the upper member in the Colorado, because there was no sharp break in the deposition of the rocks. He thought that the upper member might be of early Montana age.

Indianola Formation (undifferentiated)

Spieker (1946, p. 129) stated that there are three facies of Indianola (undifferentiated) exposed in Dry Creek, Little Clear Creek, and Hjork Canyon. These facies are a buff and gray marine facies, a buff and gray continental facies, and a red-bed continental facies. The contact between the Indianola beds and the overlying younger beds is an angular unconformity. Hardy and Zeller (1953, p. 1266) measured a thickness of 3,600 feet of indianola below the unconformity in Bear Canyon. Spieker reported the presence of a marine zone, which contains fossils of Colorado age. He tentatively regarded the whole formation to be of upper Colorado age, because the strata seem to be heterogeneous.

Price River Formation

Definition:

Spieker and Reeside (1925, p. 445) applied the name Price River Formation to a succesion of predominantly gray sandstone, grit, conglomerate, and shale between the Black Hawk Formation and the North Horn Formation. The type locality is the canyon of Price River above Castlegate, Utah.

Description of Formation:

The conglomerate of the Price River Formation is light to dark-gray, massive, and firmly cemented; it contains clasts of quartzite and limestone 2 to 4 inches in diameter. The quartzite clasts are white, gray, pink, and red; the matrix is fine to coarse-grained.

Distribution and Thickness:

The Price River Formation crops out at many localities on the Wasatch Plateau, in Mellor Canyon, several patches south of Mellor Canyon, and along the western portion of the Gunnison Plateau.

The formation is 900 to 1,000 feet thick at the type locality. Hardy (1948) measured a thickness of 1,500 feet on the west side of the Gunnison Plateau north of Mellor Canyon. Spieker (1948, p. 130) measured 1,100 feet of Price River strata in Price Canyon.

Stratigraphic Relations:

Gilliland (1951, p. 18) stated that the base of the Price River Formation is an angular unconformity, which reflects the orogenic conditions that gave rise to the formation. Spieker (1946, p. 133) described the contact between the Price River Formation and the younger North Horn Formation as transitional at all places where the two formations are known.

Age and Correlation:

Spieker (1946, p. 132) reported finding the following fossils in the Price River conglomerates and sandstones in the Wasatch Plateau: Unio priscus Meek and Hayden, Unio cf. U. danae Meek and Hayden, Sphaerium planum Meek Hayden, Modiola regularis Whitfield, Viviparus panguitchensis White, Viviparus cf. V. leidyi Meek and Hayden, Viviparus cf. V. leai Meek and Hayden, Goniobasis? subtortuosa Meek and Hayden, Goniobasis cf. G. judithensis Stanton, and Planorbis? sp. J. B. Reeside, Jr. considered these fossils to be of the late Montana stage of the upper Cretaceous system.

Spieker (1946, p. 131) stated that the Price River Formation is probably equivalent to the Fruitland and Kirtland formations of the San Juan region and other late Montana formations of the Colorado Plateau and adjacent mountains.

North Horn Formation

Definition:

Spieker (1946, p. 133) defined the North Horn Formation as the variegated beds that lie below the Flagstaff Limestone. The North Horn Formation was originally considered to be the lower member of the Wasatch Formation, exclusive of the basal conglomerates, which have been assigned to the Price River Formation. It was named after the type locality on North Horn Mountain.

Description of Formation:

The North Horn Formation consists of variegated shale, sandstone, conglomerate, some beds of coal, and limestone. These are alternating layers of fresh-water lacustrine and fluvatile origins. The fluvatile units show irregular bedding and varietal composition, which is typical of channel and flood-plain deposits.

Distribution and Thickness:

The North Horn Formation is present throughout the Wasatch Plateau, the Gunnison Plateau, and adjacent regions to the northeast.

Spieker (1946, p. 133) measured the North Horn Formation to be 2,200 to 2,500 feet thick between Castlegate and Soldier Summit. He reported an eastward thinning to 500 feet thick at Salina Creek.

Stratigraphic Relations:

The contact between the North Horn Formation and the underlying Price River Formation is gradational. There is no evidence of a break in deposition wherever these formations occur. The transition between the North Horn Formation and the Flagstaff Limestone is also gradational except for a narrow zone, which coincides with the Sanpete Valley, where the North Horn was locally truncated by erosion before the

Flagstaff Limestone was deposited.

Age and Correlation:

The age of the North Horn Formation is transitory between the latest Cretaceous and the earliest Paleocene. Spieker (1946, p. 134) stated that the age determination of the North Horn Formation was based upon the discovery of Cretaceous reptilian fossils in the lower part of the formation, and Paleocene mammalian remains in the upper part of the formation.

Flagstaff Limestone

Definition:

The Flagstaff Limestone, a succesion of lacustrine beds that lie between the variegated beds of the North Horn and Colton formations, was originally considered to be a member of the Wasatch Formation. It was named by Spieker and Reeside (1925, p. 448) after the Flagstaff Peak in the southern part of the Wasatch Plateau. The Flagstaff Limestone was later elevated to formational rank because of its distinctive lithology and widespread continuity (Spieker, 1946, p. 135).

Description of Formation:

The Flagstaff Limestone is a white and cream-colored fine-grained massive limestone containing some thin beds of shale and fine-grained sandstone. Near Willow Creek, the Flagstaff Limestone contains some calcite crystals as much as 10 inches by 10 inches by 10 inches in dimensions.

Distribution and Thickness:

The Flagstaff Limestone occurs throughout the Wasatch Plateau, in the Plateaus north of the Book Cliffs, as far west as the Pavant Plateau, throughout much of the Gunnison Plateau, and at the north end of Fish Lake Plateau.

Spieker (1946, p. 136) reported thicknesses ranging from 200 to 1,500 feet in the Wasatch Plateau, and he estimated the average thickness to be 800 to 1,000 feet. I measured the Flagstaff Limestone to be 435 feet near Willow Creek.

Stratigraphic Relations:

The Flagstaff Limestone represents a great change in lithology from the older variegated beds. These limestones were deposited in a fresh-water lacustrine environment. in most localities in the central Utah area, the Flagstaff Limestone grades into the adjacent formations. At many places in the central Sevier Valley and Sanpete Valley, the Flagstaff Limestone overlies the older beds in angular unconformity. The unconformity is the result of erosion prior to the deposition of the Flagstaff Limestone.

Age and Correlation:

Laroque (1960, p. 73) studied the fossils present in the Flagstaff Limestone, and came to the conclusion that the lower unit of the Flagstaff Limestone was deposited during the Paleocene, and that the upper unit was deposited during the Eocene.

Colton Formation

Definition:

The Colton Formation was originally classified as the upper member of the Wasatch Formation (Spieker and Reeside, 1925, p. 448). Spieker (1946, p. 136) defined the Colton Formation as the fluvial beds that lie between the Flagstaff Limestone and the Green River Formation. The type locality of the Colton Formation is in the hills north of Colton, Utah.

Description of Formation:

The Colton Formation consists mostly of red to variegated and gray mudstone. There are some beds of thin to massive-bedded limestone, and beds of sandstone. Table 2 shows a section of Colton exposed north of Ephraim Canyon.

Table 2.

Section of Colton strata exposed north of Ephraim Canyon.

Top of formation covered by alluvium.	Feet
1. Lithographic limestone, pink to white	26
2. Siliceous limestone, white	17
3. Limestone, white, massive	13
4. Siltstone, green, massive, calcareous	4
5. Limestone, massive, white	26
6. Siltstone, gray and green, massive	43

7. Siltstone, yellow, red, and green	22
8. Siltstone, green	9
9. Siltstone, red, and yellow	45
10. Siltstone, red, coarse-grained, with hematite or limonite stain	4
11. Siltstone, green-gray, coarse-grained, interbedded with red calcareous siltstone	24
12. Siltstone, red, coarse-grained, calcareous	9
13. Mudstone, red	4
14. Limestone, gray, bioturbated, lithographic	6
15. Mudstone, green and gray	26
16. Sandstone, red, calcareous	4
17. Mudstone, red and green	32
18. Sandstone, red, calcareous	2
19. Mudstone, red and gray	28
20. Limestone, white, massive, lithographic	2
21. Mudstone, red	26
22. Sandstone, gray, thin-bedded, calcareous	4
23. Sandstone, calcareous	26
24. Mudstone, red	16
25. Sandstone, gray, calcareous	1
26. Mudstone, red	14
27. Sandstone, gray, calcareous	4
28. Sandstone, yellow and red, calcareous	11
29. Limestone, gray, sandy	26
30. Limestone, gray, arenaceous	4
31. Limestone, gray, sandy	15
32. Mudstone, gray-green	6
33. Limestone, gray, sandy	4
34. Sandstone, yellow to buff, thin-bedded, calcareous	22
35. Mudstone, gray, fine-grained	155
36. Mudstone, gray, medium-grained	43
37. Limestone, yellow, thin-bedded	4
38. Limestone, tan, arenaceous	30
39. Limestone, green, lithographic	57

40.	Limestone, green and red, sandy	1
41.	Mudstone, green	18
42.	Sandstone, yellow to tan, medium-grained	2
43.	Mudstone, red, sandy	1
44.	Mudstone, red, sandy	199
45.	Limestone, gray, massive, arenaceous	22
46.	Limestone, gray, thin-bedded, with interbedded green siltstone	32
47.	Limestone, white, interbedded with buff mudstone and lenticular gray sandstone	75
48.	Mudstone, gray to black, calcareous	10
49.	Limestone, gray, sandy, with a thin bed of limestone containing numerous gastropods fossils	17
50.	Biotite sandstone, yellow, medium-grained	9
51.	Fossiliferous limestone, gray, containing an abundance of gastropod shells	1
52.	Mudstone, green and red, calcareous, with discontinuous sandstone and shale	43
	Total	1244

Flagstaff Limestone

Distribution and Thickness:

The Colton Formation occurs at numerous places along the western edge of the Wasatch Plateau, locally at the top of the Gunnison Plateau, south of Willow Creek , and at several other localities in the area.

A thickness of 1,500 feet was measured by Spieker at the type locality of the formation. I measured the Colton Formation to be 1,180 feet thick near Willow Creek. Gilliland (1951, p. 34) estimated an average thickness of 410 feet in the Gunnison Quadrangle.

Stratigraphic Relations:

The Colton Formation is a fluvatile deposit that lies conformably between lacustrine deposits. The upper and lower boundaries of the Colton Formation are generally marked by the presence of fluvatile sediments. The Colton Formation represents one of two fluvatile phases that are separated by lacustrine deposits.

Age and Correlation:

LaRoque (1956, p. 140) stated that the Colton Formation is of lower Eocene age on the basis of fossils found that belong to the <u>Viviparus</u> and <u>Elliptio</u> genera

<u>Green River Formation</u>

Definition:

The Green River Formation consists mostly of thinly laminated chalky shale. Hayden (1869, p. 190) named the formation after Green River near Rock Springs, Wyoming, where it is well exposed. The Green River Formation is of fresh-water lacustrine Origin.

Description of Formation:

The Green River Formation of Central Utah is composed of greenish-gray shale, very thinly bedded yellow limestone, and thin-bedded to massive yellow, buff, and gray limestone. Some of the limestone is replaced by blue, gray, tan, and brown chert. There are some lenses of calcareous sandstone. Locally there are beds of yellow fine-grained tuff, most of which are about one foot thick. At Temple Hill, near Manti, there are beds of massive limestone that are made up almost entirely of oolites. Some of these oolitic limestones are excellent building stone.

Distribution and Thickness:

The Green River Formation is very widespread; it occurs over much of Wyoming, Colorado, and Utah. Gilliland (1951, p. 39) measured the Green River Formation to be about 1,150 feet thick in Bald Knoll Canyon. I measured 2,230 feet of Green River strata near Willow Creek.

Stratigraphic Relations:

Gilliland (1951, p. 39) stated that the lower strata of

The Green River Formation pass transitionally into the red beds of the Colton, and that the upper contact is unclear.

Age and Correlation:

Gilliland (1951, p. 40) reported finding abundant fish remains in the green River Formation. On the basis of plant and fish remains, the formation has been considered to be middle Eocene in age.

Mid-Cretaceous Orogeny

The mid-Cretaceous orogeny as described by Spieker (1946, p. 150) was an uplift concentrated in an area west of central Utah, and probably did not affect central Utah directly. The mountains caused by the mid-Cretaceous orogeny were eroded and the sediments were deposited to form the Indianola Formation. The mid-Cretaceous orogeny is evidenced by: 1. The Indianola comglomerates consist of debris derived from Paleozoic limestone and quartzite. 2. The Indianola Formation is thicker and coarser toward the west, which indicates that the source of the rocks was toward the west. The mid-Cretaceous orogeny occured near the beginning of upper Cretaceous time.

Early Laramide Orogeny

The early Laramide orogeny was defined by Spieker (1946), and is shown by an angular uncomformity at the base of the Price River Formation. Gilliland (1951, p. 69) suggested the presence of a north trending folded belt that coincides with the Sanpete and Sevier Valleys. The following observations provided evidence for the early Laramide orogeny: 1. The youngest beds below the unconformity at the base of the Price River Formation belong to the Indianola group (Colorado age) . 2. The Price River Formation contains conglomerates, in the northern Wasatch Plateau, that get progressively finer toward the east. 3. There are no Price River or North Horn rocks at Salina Canyon, Willow Creek or Christainburg, Utah. These localities are presumed to have been positive during the time when the Price River and North Horn formations were deposited. The Price River and North Horn formations occur on either side of the area postulated as positive. Gilliland (1951, p. 69) hypothesized that the area near Salina Canyon remained positive through Flagstaff and Colton time.

Pre-North Horn (?) Movement

The pre-North Horn (?) movement was defined by Gilliland (1951, p. 74) on the basis of an angular unconformity between the Price River and the Flagstaff formations in the vicinity of Mellor Canyon. He suggested a local uplift covering a small area. He placed the date somewhere near the boundary of Price River and North Horn time.

Pre-Flagstaff Movement

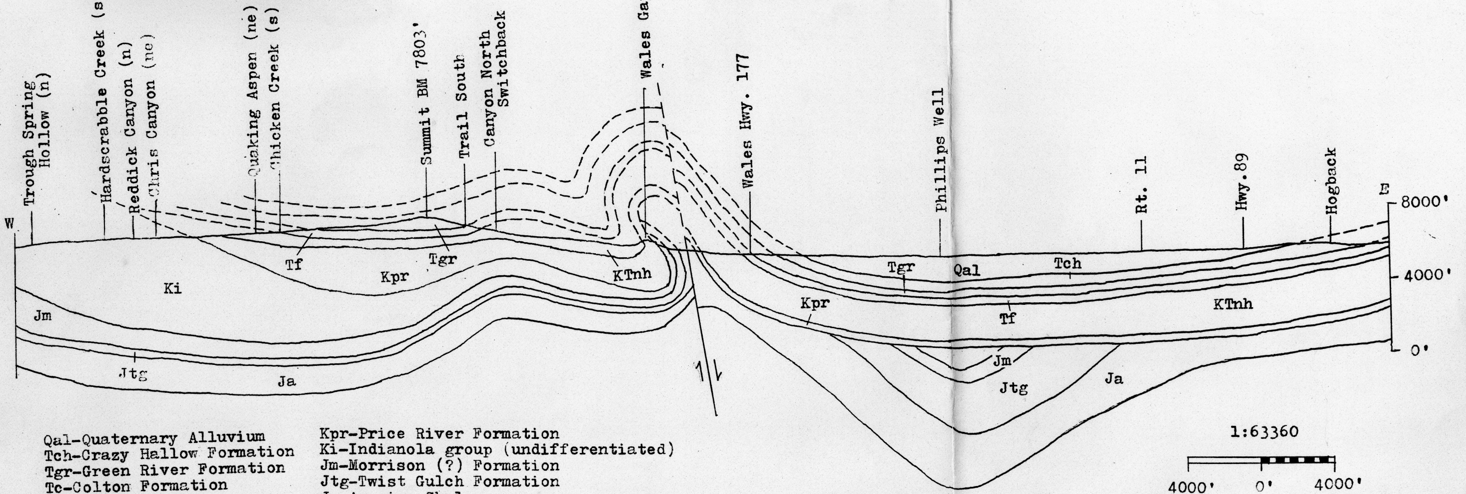
The pre-Flagstaff movement was defined by Spieker (1946, p. 155) on the basis of an angular unconformity beneath the Flagstaff near the mouth of Sixmile Canyon. This is thought to have been a local uplift because Sixmile Canyon is the only place in the area where all of the exposed North Horn strata have been tilted and truncated before the deposition of the Flagstaff Limestone.

Faulting

Gilliland (1951, p. 76) suggested that the faulting in central Utah began sometime during the Oligocene. Spieker suggested the following sequence of events in central Utah:

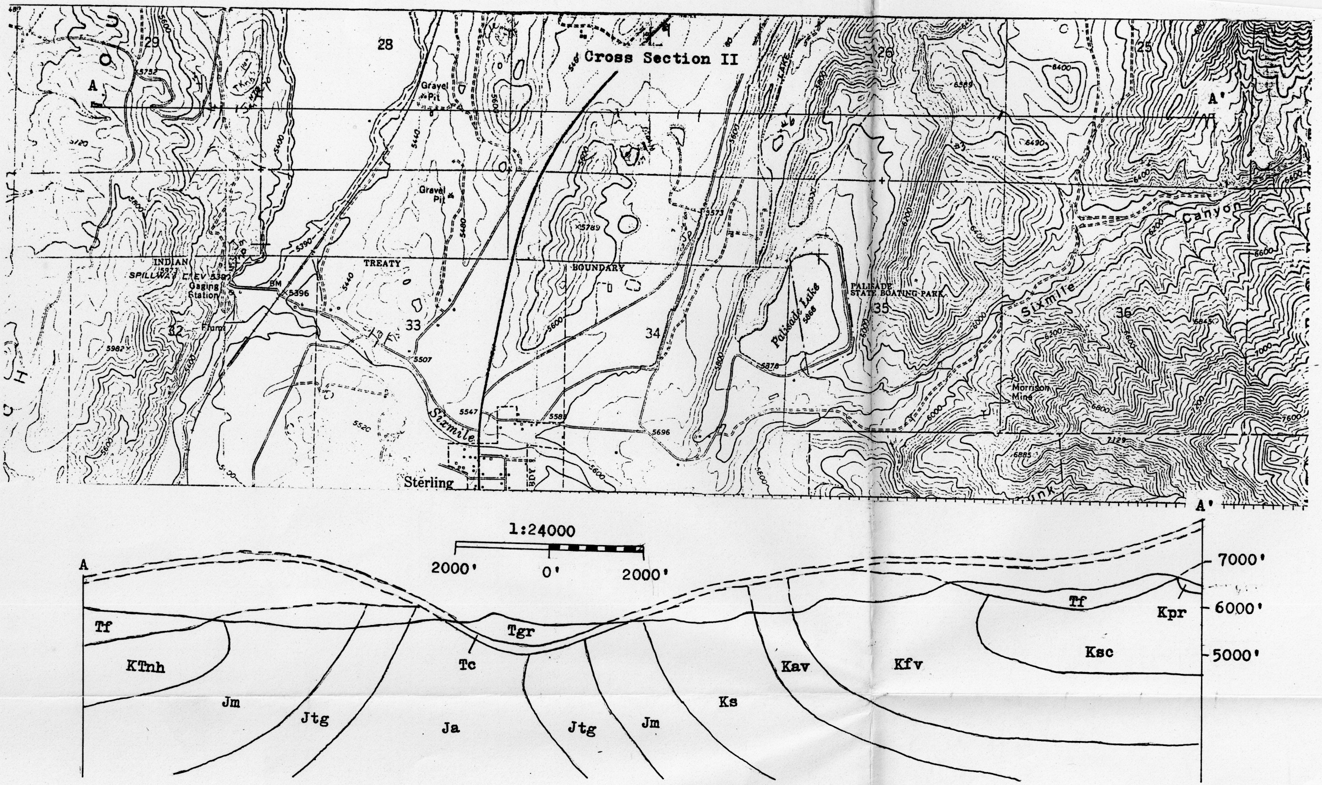
A. Folding of the Wasatch Monocline accompanied by antithetic faulting.
B. Strip thrusting along the base of the monocline.
C. Normal faulting and folding of minor magnitude continuing until present time.

Cross Section I



Qal-Quaternary Alluvium
Tch-Crazy Hallow Formation
Tgr-Green River Formation
Tc-Colton Formation
Tf-Flagstaff Limestone
KTnh-North Horn Formation

Kpr-Price River Formation
Ki-Indianola group (undifferentiated)
Jm-Morrison (?) Formation
Jtg-Twist Gulch Formation
Ja-Arapien Shale



Tgr-Green River Formation
Tc-Colton Formation
Tf-Flagstaff Limestone
KTnh-North Horn Formation
Kpr-Price River Formation
Ksc-Sixmile Canyon Formation

Kfv-Funk Valley Formation
Kav-Allen Valley Shale
Ks-Sanpete Formation
Jm-Morrison (?) Formation
Jtg-Twist Gulch Formation
Ja-Arapien Shale

GEOLOGIC HISTORY

Spieker (1946, p. 156) described the geologic history of central Utah in great detail. I will summarize the major events that occured in this area.

Cambrian and Carboniferous

A great geosyncline occupied Nevada and western Utah. The geosyncline extended into central and eastern Utah with shallower depths. Limestone and sandstone was deposited during the Cambrian and Carboniferous and the area was positive between the Cambrian and the Carboniferous.

Triasic and lower and middle Jurassic

Central Utah was positive during this time, and fluvatile and aeolian sediments were deposited.

Upper Jurassic

Central Utah was inundated by the southwest portion of the Sundance sea during the upper Jurassic. The Arapien Shale and the Twist Gulch Formation were deposited, with local restricted basins preciptating salt in some and gypsum in others. The sea withdrew later and the fluvatile Morrison (?) sediments were deposited.

Lower Cretaceous

During the lower Cretaceous, positive conditions existed. Little erosion or diastrophism occured.

Beginning of Upper Cretaceous

The mid-Cretaceous orogeny formed mountains exposing Paleozoic rocks west of central Utah. The mountains were eroded and the debris was deposited in a marine basin to form the Indianola Group.

Early and Middle Montana

During this time, littoeal environments with coal-bearing swamps existed in the area now occupied by the Wasatch Plateau. The upper portion of the Indianola was being deposited at this time.

Beginning of Late Montana

Near the beginning of the late Montana, the Laramide orogeny built mountains just west of central Utah. There was some folding in an area extending as far east as the western front of the Wasatch Plateau. A basin between the mountains to the west and the folded belt to the east recieved the sediments that make up the Price River Formation.

Late Montana to early Eocene

Near the beginning of this time, central Utah was positive with little relief, and the North Horn Formation was deposited. Later, comressional forces caused the pre-Flagstaff movement.

Central Utah was then inundated by a lake and the Flagstaff Limestone was deposited. Next, the lake began to retreat and as central Utah fluctuated betleen lacustrine and fluvatile conditions, the Colton Formation was deposited. The lakes inundated the area again and deposited the Green River Formation.

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